

Basin Modeling in Marginal Basins of the Norwegian Southern North Sea: Post-Mortem Studies of Selected Wells and Areas

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ABSTRACT

The Danish-Norwegian Basin, Egersund Basin, Ling Graben and Sele High is one of the oldest exploration provinces of the Norwegian Continental Shelf with wells drilled as early as 1966. It is an area with many dry wells where a good understanding of source rock facies, maturity and migration is critical for exploration success. The Norwegian Southern North Sea has two prolific petroleum systems: in the South-West (the Central Graben) and the North-West (the South Viking Graben), with fields like Ekofisk and Sleipner, respectively. The latest significant discovery is on the Southern Utsira High, where the Johan Sverdrup Field is part of the South Viking Graben petroleum system. Outside these two graben systems, in the Danish-Norwegian Basin, Egersund Basin, Ling Graben and Sele High, the Upper Jurassic source rocks are marginally mature to immature. There are, however, still some potential for discoveries here, but the success rate in exploration drilling is low. Over the last ten years, approximately fifteen exploration wells have been drilled in the areas with marginally mature Upper Jurassic source rocks. Ten of these wells were selected for a “post mortem” examination: 8/5-1 (dry), 8/10-3 (dry), 8/10-4 S (oil), 9/1-1 S (dry), 10/4-1 (dry), 11/5-1 (dry), 16/8-3 S (dry), 16/10-5 (dry), 17/6-1 (oil shows), 26/10-1 (gas). Only one well (8/10-4 S) made a commercial discovery, the Oda field. The post mortem evaluations use a regional basin modelling study from 2007 to make charge and accumulation history predictions for the wells. The study is based on a regional stratigraphic framework from seismic interpretation and sequence stratigraphy, and includes geochemical source rock facies mapping and pseudo-3D basin modelling. Expelled volumes of four components of hydrocarbon are calculated at time steps from the source rocks. Charge predictions are made by integration of these volumes through time within drainage areas and geohistories. The results of the post mortem evaluation show a good match between predictions that could have been carried out prior to drilling and the actual results. It seems that a higher success rate in exploration drilling could have been achieved with more emphasis on basin modelling results. This study demonstrate the value of high quality basin modelling work in marginal areas such as parts of the Norwegian Southern North Sea.